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HEXABROMIDES OF GLYCERIDES AND FATTY ACIDS.

By John Walker and George Warburton.

(*Read at the Meeting, April* 9, 1902.)

In a paper by Hehner and Mitchell, published in the Analyst of December, 1898, there is given a convenient method for the determination of the hexabromides obtainable from oils and their fatty acids. This was accompanied by some figures obtained by the authors in the course of their investigations.

The following table may be of value to those interested in the subject, particularly as some of the figures given refer to oils not hitherto examined in this direction:

Kind of Oil.	Per Cent. Yield of Hexabromide from Glyceride of Fatty Acids.		Per Cent. Yield of Hexabromide from Fatty Acids.		
Japan fish	21·14	22·07	23·04		23·32
Newfoundland cod ...	32·68	30·62	39·1		37·76
Shark-liver	21·22	19·08	12·68		15·08
Genuine cod-liver ...	35·33	33·76	29·86		30·36
Deodorized fish	49·01	52·28	38·42		39·27
Sperm	2·61	2·42	2·05		—
,, ...	3·72	3·69 (stood 48 hours)	—		—
Whale	15·54	16·14	12·38		12·44
Seal	27·54	27·92	19·83		19·93
Rape	—	—	2·44		3·38
Linseed (iodine value 184)	—	—	31·31	30·44	30·80
Liquid acids (iodine value 208)	—	—	34·9		—
Linseed (iodine value 181)	23·14	23·52	29·06		29·34
Candle-nut	8·21	7·28	11·53	11·23	12·63
Chinese-wood (1st sample)	0·38	0·39	—		—
,, ,, (2nd sample)	none		—		—
Safflower	—	—	1·65		0·65

The work was carried out in the laboratory of Dr. Lewkowitsch.

Discussion.

Mr. Hehner inquired whether Dr. Lewkowitsch (who read the paper in the absence of the authors) could explain why, in some cases, the fatty acids yielded so much smaller percentages of hexabromide than the glycerides.

Mr. C. A. Mitchell said that since the paper by Mr. Hehner and himself, to which reference had been made, he had examined a large number of linseed oils, and almost without exception the quantity of hexabromide yielded was from 23 to 25 per cent. In one case 42 per cent. had been obtained, but he did not know the origin of the oil. He had not been able to reduce the compound, even after treatment with zinc for several hours.

Dr. Lewkowitsch said that the point referred to by Mr. Hehner was a somewhat curious one, and required explanation. He was not himself responsible for the figures, which were simply given as they were obtained in the actual experiments. The collection, however, of individual figures such as these could not but tend to an increase of knowledge in regard to the individual oils concerned.

ON THE DETERMINATION OF MINERAL OIL IN ROSIN OIL.

By John H. Walker and Charles D. Robertshaw.

(*Read at the Meeting, April* 9, 1902.)

The correct determination of mineral oil in rosin oil is still an unsolved problem.

We recently had occasion to determine small quantities of mineral oil in rosin oil, and in the course of the examination we made a number of experiments with the methods which have been proposed for the solution of this problem. *McIlhiney's* method for estimating rosin oils in vegetable oils consists in ascertaining the bromine substitution figure. This is very low for vegetable oils, but somewhat considerable for rosin oils, the figures given by him for rosin oil varying from 42 to 90. Since the bromine substitution value of mineral oils must be very low, if any, it was thought that the application of this method might lead to good results. The first step was to ascertain whether the method yields constant results, and with this view a genuine rosin oil was examined, with the following results:

Bromine Values of Rosin Oil.

	Bromine Absorption.	Substitution.	Addition.
No. 1 ...	112	58·37	– 4·34
No. 2 ...	116·5	59·95	– 3·40
No. 3 ...	105·8	56·56	– 7·32

A second set of experiments led to absorption figures varying from 95·7 to 129·2. Another genuine rosin oil gave values varying from 77·9 to 109·1.

This proves that the reaction taking place is not a very definite one, and that the results depend not only on variations of time, temperature, and other conditions, but even in comparative tests and under exactly the same conditions the results remained very unsatisfactory. In fact the numbers obtained above were got in

experiments worked under exactly identical conditions, and using ice, as directed by McIlhiney. This is further emphasized by the very erratic figures obtained when applying the Hübl or Wijs methods to the oils in question.

Similar tests made with two mineral oils led to the following figures :

	Bromine Absorption.	Bromine Value calculated from Iodine Value.
Mineral oil, No. 1 ...	16·8 to 29·2	9·6
,, ,, No. 2 ...	21·9 to 27·4	11·7

From the foregoing it would appear a hopeless task to determine quantitatively the rosin oil in a mixture of rosin oil with mineral oil. This is shown in several experiments carried out by mixing 90 parts of rosin oil No. 1 with 10 per cent. of mineral oil No. 1. The figures obtained were as follows :

	Bromine Absorption.	Bromine Value calculated from Iodine Value.
Mixture of 90 per cent. rosin oil No. 1 and 10 per cent. mineral oil No. 1	70·4 to 98·6	33·8

Recently *Holde* proposed a method for detecting and determining rosin oil and mineral oils by their different solubility in 96 per cent. alcohol, when 10 c.c. of the sample are shaken with 90 c.c. of 96 per cent. alcohol in a stoppered measuring cylinder, the refractive index of the insoluble portion being then taken. The undissolved portion would indicate the presence of mineral oil. This naturally presupposes that pure rosin oil is completely soluble, and that may have been the case with the rosin oils examined by Holde, but the samples of pure rosin oils which we tested left a considerable residue at the bottom of the cylinder. In the case of rosin oil No. 1 about thirty per cent. was left undissolved, and in the case of rosin oil No. 2 forty per cent. Whether this is due to our rosin oils having been freed from the rosin acids or not has not been investigated, but at any rate we feel justified in concluding that Holde's method does not admit of general application. The sample of mixed rosin and mineral oils—90 and 10 respectively—gave 60 per cent. of insoluble substance.

The best method of determining the mineral oil in rosin oil was found to be Valenta's acetic acid method. The percentage of rosin oil dissolved in the acetic acid was, in the two cases of genuine rosin oils, 16·8 and 16·6 per cent. respectively, which compares well with Valenta's figure of 16·9 per cent.

The mineral oil No. 1, used for preparing the mixture, gave 4·4 per cent. (Valenta stating 2·6 to 6·5 per cent.). A mixture prepared from equal parts of the mineral oil and the rosin oil No. 1 gave 10·84 per cent. insoluble, theory requiring 10·59 per cent.

So far, then, our experience shows that Valenta's method is the best. As a preliminary test, the determination of the specific gravity will certainly give very valuable hints.

The above experiments were carried out in the laboratory of Dr. J. Lewkowitsch.

Discussion.

Mr. Jenkins said that of the mineral oils, that from Borneo was the one which came nearest in its reactions to rosin oil. Its specific gravity was from 0·97 to 0·99, and it was very readily soluble in an equal volume of acetone. It did not give the Liebermann-Storch reaction, but in several other respects, and especially in solubility, it approximated to rosin oil.

Dr. Lewkowitsch observed that the peculiarities of Borneo oil afforded a further proof of the danger of generalizing from the results yielded by a limited number of samples. If this short paper were merely considered as a sort of warning, he thought the authors would have done well in drawing attention to the matter.

THE COMPOSITION OF MILK.

By H. Droop Richmond, F.I.C.

(*Read at the Meeting, May* 7, 1902.)

Mean Composition during 1901.—Of the 37,662 samples examined in the Aylesbury Dairy Company's Laboratory during 1901, 32,635 were analyses of milk. The composition of 13,936 received from the farms is given in Table I.

Table I.

Average Composition of Milk during 1901.

Month.	Morning Milk.				Evening Milk.				Average.			
	Specific Gravity.	Total Solids.	Fat.	Solids-not-Fat.	Specific Gravity.	Total Solids.	Fat.	Solids-not-Fat.	Specific Gravity.	Total Solids.	Fat.	Solids-not-Fat.
January ...	1·0328	12·58	3·52	9·06	1·0327	12·90	3·83	9·07	1·0328	12·73	3·67	9·06
February...	1·0328	12·58	3·54	9·04	1·0326	12·94	3·88	9·06	1·0327	12·74	3·70	9·04
March ...	1·0326	12·49	3·50	8·99	1 0325	12·85	3·85	9·00	1·0325	12·65	3·66	8·99
April ...	1·0323	12·38	3·46	8·92	1·0320	12·73	3·85	8·88	1·0321	12·55	3·66	8·89
May ...	1·0326	12·25	3·29	8·96	1·0323	12·70	3·76	8·94	1·0324	12·47	3·52	8·95
June ...	1·0326	12·25	3·31	8·94	1·0320	12·58	3·70	8·88	1·0323	12·42	3·51	8·91
July ...	1·0319	12·17	3·41	8·76	1·0313	12·37	3·69	8·68	1·0316	12·27	3·55	8·72
August ...	1·0319	12·27	3·47	8·80	1·0313	12·59	3·85	8·74	1·0316	12·43	3·66	8·77
September	1·0321	12·47	3·59	8·88	1·0317	12·89	4·03	8·86	1·0319	12·68	3·81	8·87
October ...	1·0321	12·58	3·69	8·89	1·0316	13·02	4·15	8·87	1·0318	12·80	3·92	8·88
November	1·0321	12·74	3·82	8·92	1·0317	13·03	4·14	8·89	1·0319	12·89	3·98	8·91
December	1·0322	12·75	3·80	8·95	1·0319	13·13	4·18	8·95	1·0320	12·94	3·99	8·95
Average	1·0323	12·46	3·53	8·93	1·0320	12·81	3·91	8·90	1·0321	12·63	3·72	8·91

The morning and evening milks have been kept separate, and show the usual average difference of 0·3 to 0·4, which has been always previously observed. In previous years the average percentage of fat has usually shown a slight fall from that found in the previous year; in 1901 there is a distinct rise, the percentage being 3·72 as against 3·64 in 1900. This rise is chiefly due to higher figures in the last four months, which average 0·16 per cent. higher than the corresponding months of 1900, the rise in the previous eight months averaging only 0·03 per cent.

The cause of this is uncertain, but the fact that the rise in fat percentage is coincident with the establishment of an official standard may indicate that milk-producers are paying more attention to the quality of the milk yielded than formerly.

The former experience that the lowest fat occurs in May and June and the highest in the winter months, and that the solids-not-fat are low in July and August, is again repeated.

Accuracy of Methods Used.—As in the bulk of the analyses the fat is determined by the Gerber method, I have compared the results with those obtained by the Adams method for fat.

In 52 analyses the difference between Adams and Gerber was :

In 40 cases, or 76·9 per cent., 0·1 or less ;
In 11 cases, or 21·2 per cent., 0·1 to 0·15 ; and
In 1 case, or 1·9 per cent., above 0·15.

The mean Gerber figure was 0·006 per cent. higher than the mean Adams figure.

The Proteids of Milk.—In a paper read last year (ANALYST, xxvi., 310) I showed that when the minimum quantity of a mineral acid was added to milk the quantity necessary to just curdle the milk on boiling was practically equal to the amount necessary to replace the sodium by hydrogen in the formula :

$$C_{162}H_{255}N_{41}SPO_{52}CaNa.\tfrac{1}{2}(Ca_3PO_4).$$

As a further confirmation of the view that this is the action that takes place, I determined the casein, ash, lime, and phosphoric acid in a sample of milk, and in the serum obtained by curdling with a minimum quantity of hydrochloric acid at the boiling temperature the figures were :

	Milk.	Serum.	Difference.
Casein	3·05	—	—
Ash	0·79	0·56	0·23
CaO	0·176	0·056	0·120
P_2O_5	0·232	0·112	0·120

The figures calculated for the removal of Ca and $\frac{1}{2}(Ca_3PO_4)$ with each molecule of casein are :

Ash	0·234
CaO	0·116
P_2O_5	0·118

The difference between the solids-not-fat after allowance for the ash was 2·91 per cent., and I have constantly found that the quantity of casein removed does not quite coincide with the estimate of the quantity of casein present. I do not propose at present to discuss the significance of this fact.

In the same paper I also mentioned that on filtration through porcelain the casein and albumin were both removed. There is a possibility that both albuminoids may exist in milk in combination, and the compound may only be split up under the influence of reagents. It appeared to me that filtration through filter-paper would settle the question. I filtered half a litre of milk kept at 0° C. ; three fractions were collected, and it was found that the last fraction, which contained a trace of casein, contained sensibly the same amount of albumin as the portion left on the filter, which was very rich in casein. As it does not appear probable that filtration through

paper would break up a compound, it may be concluded that casein and albumin are not decomposition-products of one albuminoid existing in milk.

Attempts were made to ascertain whether any change in the acidity of milk took place when the albumin was coagulated by boiling; a quantity of acid sufficient to curdle the milk at temperatures below the coagulating point of albumin was added to milk, the serum removed, and the acidity estimated before and after boiling. The results showed considerable variation, the reduction of acidity varying from 3·6° to 5·3° in the same milk; it was, however, found impossible to completely remove the casein, which probably existed in suspension, and was removed on boiling. The casein was estimated as organic phosphoric acid by the method given in "Dairy Chemistry" (p. 113),* and the greatest reduction was found where the greatest amount of casein was present, and *vice versâ*. The amounts of casein found would account for the greater portion of the reduction of acidity, and that due to the coagulation of the albumin must be extremely small; as experimental error would bear a large proportion to the absolute amount, it appeared hopeless to attempt quantitative determinations in this way.

A series of experiments was carried out to ascertain the strength of casein as an acid. It was certainly stronger than carbonic acid, as $\frac{1}{100}$ N. solutions of sodium and potassium carbonate dissolved 1·86 and 1·83 per cent. of casein respectively, the quantity calculated for the replacement of 2H by the alkali in $C_{162}H_{258}N_{41}SPO_{52}$ being 1·84. Boric acid produced in concentrated solution a partial coagulation on boiling, and casein is probably a somewhat stronger acid than boric under these conditions. Organic acids, such as acetic and lactic acids, were distinctly stronger than casein, as nearly the same amounts (9 to 10 c.c. normal acid per litre) were required to curdle milk as those of mineral acids (8·6 c.c.). Phosphoric acid was quite anomalous in its behaviour, as about 34 to 35 c.c. were required to curdle milk on boiling. This behaviour of phosphoric acid incidentally shows that milk is neutral to the casein compound which exists in milk, as, were it not so, a mineral acid should liberate phosphoric acid from the phosphates present, and a larger quantity of acid than that required to replace one atom of base for each molecule of casein should be necessary. This, I think, indicates that casein is an acid of the same strength as the second hydroxyl of phosphoric acid, as I have previously shown (*loc. cit.*) that the phosphates of milk are mono- and diphosphates.

Composition of Human Milk.—Four samples of human milk were examined. The composition was:

	I.	II.	III.	IV.
Specific gravity	1·0329	1·0294	1·0285	—
Total solids	11·45	10·48	11·90	13·77
Fat	2·53	2·63	4·00	5·60
Sugar (by difference)	6·87	6·34	6·06	6·74
Proteids	1·77	1·25	1·62	1·24
Ash	0·28	0·26	0·22	0·19
Zeiss refraction of fat at 35° C.	51·5°	—	—	53·2°
Sugar (gravimetric as lactose)	6·42	—	—	—
,, (polarized as lactose)	—	5·62	—	—
,, (polarized as sugar, having $[\alpha]_D$ 48·7°)	—	6·39	—	—

* I now find that it is unnecessary to add alkali to the filtrate from the mercuric nitrate solution before evaporation and ignition; the ash is always strongly alkaline without this.

The only figures calling for any remark are the sugar estimations. In conjunction with Professor Carter (*British Medical Journal*, 1898, No. 1) I have shown that the sugar of human milk appeared to differ from lactose, and had an $[\alpha]_D$ for the anhydrous sugar of 48·7°; the cupric reducing power is also slightly less than that of lactose. The present figures bear this out.

NOTE ON A CONVENIENT APPARATUS FOR THE CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF THE ATMOSPHERE.

By William Chattaway, F.I.C., and F. M. Wharton, F.I.C.

(*Read at the Meeting, May* 7, 1902.)

As impurities in the air, or at least such gases as have to be estimated in the ordinary way in the atmosphere, are present in comparatively small quantities, and as the error of experiment naturally affects such determinations in proportion to the volume of air examined, we have thought it best to adopt a plan whereby a very large volume of air may be tested, instead of using a few litres as has usually been done previously.

Some years ago one of us had occasion to examine large volumes of ozonized air, and the accuracy of the anemometer as a means of measurement was clearly established. Indeed, it was partly owing to the experiments referred to that the present apparatus was made.

We have recently had occasion to examine the atmosphere in and around a large chemical works where smelting processes were conducted, and the satisfactory way in which the apparatus worked seemed to justify the matter being brought to the notice of this Society.

In order to bring whatever liquid is used to fix the impurities sought for into contact with the air to be examined, we are satisfied that a jet apparatus is the most efficient and, at the same time, the most expeditious. For example, it is possible, in the course of half an hour, to treat at least 100 cubic feet of air, and, with the exception of CO_2 (which is admittedly somewhat difficult to determine by this method on account of the slowness of absorption), we believe that almost all other impurities can be dealt with in an exceedingly efficient and expeditious manner.

Briefly, the apparatus consists of a pump capable of giving a pressure equal to about 2 inches of water, which is used to force the air under examination through the perpendicular tube of an ordinary atomizing jet. The jet is placed inside a fairly large carboy, and the exit for the scrubbed air is an essential feature. This consists of a little spray trap, which is always kept wet during the process. The air is forced through the carboy by means of pressure from the pump, and the volume passed is finally measured by the anemometer. The anemometer must be protected against any form of back-pressure. The size of the carboy, the jet, and, within certain limits, the pressure, may be varied to suit any particular purpose, but we much prefer to work on a reasonably large scale.

Satisfactory results can be obtained with a powerful foot-pump, provided the

metal parts are covered so as to guard against contact of the moist air with the metal, but, wherever possible, we prefer to use a pump similar to the one we have here to-night, driven by some convenient power. The chief points about this pump are that it has a flexible piston, that it does not require any form of lubrication, and that the few metal parts present are coated with anti-sulphuric enamel. This renders the likelihood of chemical action quite out of the question.

We do not claim that this apparatus is novel, except in so far as the use of an anemometer is concerned and the treatment of large volumes of air, but we do claim that it is a convenient and very reliable means for determining the impurities sought for.

We find that the spray method has been previously employed, and it is doubtless a very old plan, but we are not aware that it has been used either for bacteriological purposes or for dealing with large volumes of air as we suggest.

The only fault that appears to exist in the use of the apparatus is the inconvenience of the liquid being carried forward during the experiment. The accuracy, however, which is obtained by working on such large volumes more than compensates for the trouble which is thus involved.

With regard to special estimations, we may mention that we have not established that CO_2 can be readily estimated by one scrubbing, but it is not important, as one can easily obviate the errors arising from CO_2 when estimations of other gases are made.

We have obtained some encouraging results on the determination of SO_2 as $BaSO_4$ after oxidation of the aqueous liquid, but further experiments are being made in this direction.

Metallic impurities, such as lead, zinc, etc., in the form of dust or fumes, flue, gases and the like, can be readily dealt with by means of dilute alkali. If, however, soda is used it should be prepared from metallic sodium. Dust can also be readily removed by merely scrubbing with water.

Ozone can be readily estimated by the usual methods, and nitric oxide, free and albuminoid ammonia can be likewise estimated by this method.

In addition, the speed which may be obtained on a large scale is such as to justify, in our opinion, the possible application of this method for removing dust particles from the air in the case of breweries, photographic works, etc.

On a much smaller scale, but adopting exactly the same principle, an apparatus is shown which may be readily and quickly used for bacteriological examination of the atmosphere. In this case the only difference is that the volume of air is much smaller, and therefore need not be measured by means of an anemometer; but the air which has been forced through the jet can be measured by collection in a graduated vessel.

We prefer to directly scrub the air with sterile nutrient broth, precaution being first taken to thoroughly sterilize the apparatus. In order to obviate possible risk of contamination, if the broth were removed in the ordinary way, a little side-opening is made which will permit of a sterile pipette being used for removing the broth. In this way it is quite easy to determine, from a known volume of air and using a known volume of broth, the number and nature of the organisms found. We suggest that

this method is particularly applicable to examination of the atmosphere of breweries and similar works where the introduction of foreign micro-organisms is of vital importance. Of course, instead of using nutrient broth, it is quite possible to use sterile wort or other suitable liquid media.

We are aware that the same results are obtained with other forms of apparatus, but we do not think that the same degree of accuracy has been obtained. We have established that it is possible to remove all the micro-organisms in the atmosphere with this apparatus. In the case of the Hesse apparatus, we think there is a certain risk of not removing all the micro-organisms; and, again, with Hueppe's method, where the air is bubbled through warm nutrient gelatin, we think that objection can be taken as to the thoroughness of this operation compared with that of the atomizing method which we suggest.

THE EXAMINATION OF WATER FROM SOME TYPHOID-POLLUTED WELLS.

By Samuel Rideal, D.Sc., F.I.C.

(*Read at the Meeting, June* 4, 1902.)

In December last year I received two samples of water from shallow wells for partial analysis as to whether they were suitable for drinking purposes. The chemical results for the two waters were as follows:

Parts per 100,000.

	No. 222.	No. 223.
Total solids	29·36	75 92
Chlorine	1·48	3·96
Nitric nitrogen	2·59	2·54
Nitrous nitrogen	Nil.	Trace.
Free ammonia	0·0045	0·0028
Albuminoid ammonia	0·0075	0·0132

Having analysed a considerable number of waters during the last few years from the shallow wells in this district, I have been able to fix a fairly rigid standard, from which I did not hesitate in condemning No. 223 as badly polluted and No. 222 also as unsuitable for drinking purposes, mainly on account of its high nitric nitrogen figure. After the analyses, I received notification from the sanitary inspector to the effect that both the waters had been taken where there was a case of typhoid fever in the house—No. 222 from a cistern in the house fed from a well in the grounds, depth unknown; and No. 223 from a garden well-pump about 20 feet deep—and a letter from the medical officer remarking on the somewhat high standard which I adopted for these shallow well waters. On receiving this information, although both the samples had been collected in ordinary stoppered half Winchester quart bottles not previously sterilized, and had stood about the laboratory some days, I determined to proceed with a bacteriological examination of the residues, amounting in each case to about 250 c.c., and containing the sediment from the whole of the sample.

From the residue of No. 223, the water showing the worse chemical results, no coli or other suspicious organisms were obtained, and, in fact, the bacteria growing at blood-heat seemed to have entirely disappeared. From the residue of No. 222 a number of more or less typical cultures of *Bacillus coli* were obtained, and an organism which, from its growth and reaction with the following different cultural tests, was almost certainly *Bacillus typhosus*:

Surface colony on agar, closely resembling typhosus; delicate, light-brown colour, finely granulated, and no centre.

Gelatin streak culture; grew somewhat slowly at 20° C., and no signs of liquefying after some weeks' incubation.

Agar streak culture; a marked growth in twenty hours at 37° C., resembling typhosus.

Culture in peptone water at 37° C.; growth, but no indol reaction could be obtained after four days' incubation.

Milk culture at 37° C.; not coagulated after seven days' incubation.

Agar shake culture at 37° C.; no gas formation.

Potato at 37° C.; no visible growth after twenty hours.

Proskauer and Capaldi's media; twenty hours at 37° C.—

"No. 1." No production of acidity or apparent growth (resembling typhosus; coli organisms grow, producing marked acidity).

"No. 2." Growth, but no acid reaction.

In all these tests it will be seen that, with the solitary exception of its failure to produce acidity in twenty hours in Proskauer and Capaldi's No. 2 medium, it conforms to the typhoid bacillus. Examined microscopically, the organism was seen as very motile short rods, with occasional long threads bent at an obtuse angle. Stained by Van Ermengem's process, flagella were demonstrated, but they were not so numerous as in other typhoid cultures, and in other respects the organism was proved to be enfeebled and not so resistant to the action of chemicals as stock cultures of *Bacillus typhosus*.

A report of this was sent to the medical officer, who very kindly forwarded some of the typhoid patients' blood for Widal's agglutination test. A negative was obtained with normal blood serum, and very rapid and marked clumping with the anti-typhoid blood serum from the patient.

Discussion.

The President (Dr. Voelcker) observed that the main ground for suspicion in the case of the first water was the large amount of nitrates present. It would have been interesting to know the amount of oxidizable matter in this water, and whether there was anything in the appearance of the sample that would arouse any suspicion of its bad quality. Certainly the water would seem, on the chemical figures, to be one to which some suspicion might attach. Still, the strictly chemical data available were perhaps scarcely sufficient to decide upon alone. If, however, associated with the amount of nitrates present, there was a considerable amount of organic matter, or if there was anything in the appearance of the water that would lead one to think

that it was not altogether right, there would be confirmation of the suspicion. The second water, presumably, was also from a shallow well, and quite near the first one. Still, the great variation in the amount of total solids required some explanation. It might naturally be asked, too, whether, as in the case of the first water, confirmatory indications of bad quality were yielded by bacteriological examination.

Mr. W. H. Jollyman inquired whether *Bacillus coli* had been isolated from these waters, as well as the supposed typhoid organism, and also whether any experiments had been made to ascertain if, in the case of the patient referred to, the blood clumped the *B. coli*, and if the organism in question was clumped by normal blood. He thought that such control experiments would be necessary before one could say for certain whether or not the organism was typhoid.

Dr. Rideal said that he had experimented with normal blood, and had found that the organism did not agglutinate with it. He had not tested the patient's blood with *B. coli*, because he was certain from his previous examination that this particular organism was not *B. coli*. All the tests proved that it was not *B. coli*, and pointed to its being typhoid, and he regarded the agglutination test as confirming what might be called the negative results obtained in the previous work. *B. coli* had been isolated from, and was present to a considerable extent in, sample No. 222; but in the case of sample No. 223, the organisms developing at blood-heat had apparently disappeared during the time the sample had remained standing. In the unpolluted shallow well-water of the district the chlorine was always much lower than was the case in these samples, as was also the nitric nitrogen. He should regard 1 part in 100,000 as a fair normal figure for the chlorine, and less than 0·6 part for the nitric nitrogen. He was unable to state the amount of oxygen absorbed by oxidizable organic matter in either of these two waters, but the opinion he had formed without the aid of that factor had been shown, he thought, to have been a justifiable one.

ON BELFIELD'S TEST FOR BEEF-STEARINE IN LARD.

By Otto Hehner.

Upon the form of the crystalline deposit obtained from an ether solution of lard is based the only method extant for the detection of beef-fat in lard. Pure lard, as a rule, gives, as is well-known, crystals which are flat, with chisel-shaped ends, sometimes single, often bunched together, and radiating from a centre, while in presence of beef-fat the crystals form exceedingly thin needles, curved, united in the form of wheatsheaves or horsetails, with pointed ends.

It has been shown by Mitchell and myself (Analyst, vol. xxi., p. 328, and *American Chem. Soc. Journal*, vol. xix., 1897) that the "form of the beef-crystals is solely due to a larger proportion of stearic acid than can be obtained from pure lard by a single crystallization," and that by recrystallizing the deposit the stearic acid accumulates to such an extent, even in deposits from pure flare lard of average composition, that the crystals become indistinguishable from those obtained from beef-fat.

In the paper referred to a number of determinations of stearic acid in lards and other fats are given, showing that the highest percentage of stearic acid met with by us up to that date was 16. It was to be expected that in lards with a higher proportion of stearic acid the form of the crystals would more and more nearly approach to that associated with beef-fat. I have lately melted out in the laboratory from a piece of pig's flare some lard which gave an iodine absorption of only 45·6, and containing, as the average of two satisfactorily agreeing determinations, no less than 24·91 per cent. of stearic acid. The crystals from this sample are indistinguishable from those of lard largely admixed with beef-fat. In a second sample of flare-fat I found 20·75 per cent. of stearic acid; the ether-deposit from this sample also closely resembled that of beef-stiffened lard. A sample of mutton-fat contained 27·4 per cent. of stearic acid, and the crystals had all the appearance of beef-stearine crystals.

As, with the exception of the figures published by Mitchell and myself, no data as to the percentage of stearic acid in fats, based upon direct determination, are available, I think it worth while to place the above numbers on record. They should make analysts very cautious in placing reliance upon the form of the ether-deposits. When cotton-seed or other vegetable oil can be traced, and the iodine absorption is high, the "beef-form" of crystals may be taken to afford evidence of the presence of beef or mutton fats. In the absence of vegetable oil and with a low iodine absorption, the Belfield test can at most afford some reason for suspicion, but no trustworthy evidence of adulteration.

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

FOODS AND DRUGS ANALYSIS.

The Analysis of Dutch Butter. **A. Kickton.** (*Zeit. für Untersuch. der Nahr. und Genussmittel*, 1902, v., 458, 459.)—Attention is drawn to the desirability of applying the phytosterol acetate test (ANALYST, xxvii., p. 94) to Dutch butters which give a low Reichert-Meissl number, and with which the colour tests for cotton and sesame oils yield negative results, before giving a definite opinion as to the presence of margarine in the butter. W. P. S.

The Polarization of Fruits, Jellies, Jams, and Honey. **L. M. Zolman.** (*Journ. Amer. Chem. Soc.*, xxiv., 515.)—From his experiments the author comes to the conclusion that the presence of hydrochloric acid increases the lævo-rotation of an invert sugar solution, and that this explains why, when hydrochloric acid is added to a solution of sucrose inverted by boiling with an organic acid, such as occurs in jams and jellies, a slightly higher reading is always obtained. The increase is proportional to the quantity of hydrochloric acid present, and to the amount of

polarization, at any definite temperature. Introducing the correction calculated from his results into the Herzfeld formula, he obtains

$$S = \frac{a - b}{141{\cdot}85 + 0{\cdot}05b - \frac{T}{2}}$$

where S = sucrose, a = direct reading, b = invert reading, T = temperature. The modified formula corresponding to the method used by the Association of Official Agricultural Chemists is

$$S = \frac{a - b}{141{\cdot}79 + 0{\cdot}062b - \frac{T}{2}}$$

whilst, to calculate a small amount of cane-sugar in the presence of a large amount of invert sugar, the formula

$$S = \frac{a - [b - (0{\cdot}062 \times b)]}{141{\cdot}79 - \frac{T}{2}}$$

should be used.

The presence of hydrochloric acid has no effect on the polarization of solutions of glucose. A. G. L.

Valuation of Flour for Bakers' Use. A. Maurizio. (*Landw. Jarhb.*, 1902, xxxi., 179; through *Chem. Zeit. Rep.*, 1902, 155.)—The author's experiments show that no opinion as to the suitability of a flour for baking can be based upon an extraction of the gluten, followed by an estimation of its power of rising when tested in an aleurometer, baking oven, or oil-bath. In general, however, the volume of the bread increases as the volume of the gluten. The quality of the gluten is an important factor; but, although its valuation, according to the usual practical methods, throws some light upon the quality of the flour for baking, the desirable qualities of the gluten cannot be formulated in precise language. The chemical processes of Robine and Girard are useless. Neither the amount of extractive matter recovered from gluten or flour, nor the specific gravity of solutions in acetic acid and alcoholic potash indicates the value of a sample to the baker. An estimation of the bulk of the bread or of the experimental cakes made in sheet-metal vessels with maize grits, glass pearls, etc., is of no value because of the different conditions in which they are obtained and of their irregular shapes. The volume of the fermented dough and of the finished bread do not depend upon the absolute quantity of carbon dioxide liberated by the yeast, but upon the power of the dough to retain more or less gas before it sets. Poor flours lose gas during fermentation; better descriptions hold it until they are placed in the oven. It would be advantageous if the loss of gas before baking could be avoided; but, on the other hand, there is a maximum volume for the bread, above which its quality suffers. The fermented doughs of different flours show differences in volume; but those differences are smaller than such as are given by different sample cakes of the same flour, while the volumes of the doughs do not agree with the volumes of the finished cakes. Fermentation tests, accordingly, cannot replace baking tests. The specific gravity of the bread is an excellent criterion for judging of the value of a flour or wheat for bakers' use. Products of

the best quality have a specific gravity of 0·23 to 0·28; medium qualities show 0·35; inferior grades give 0·46 or more. F. H. L.

On Specific Sera for Human Blood. Linossier and Lemoine. (*Acad. de Médecine*, March 25, 1900; *Ann. de Chim. anal.*, 1902, vii., 185.)—The authors have found that the specific character of the sera obtained by injecting rabbits with human serum (ANALYST, xxvii., p. 194) is not so absolute as has frequently been asserted. According to the results of their experiments the sera are not specific when a too concentrated solution of blood serum is employed, although the precipitate is more pronounced than in the case of the blood of other animals.

To avoid this source of error the test should only be applied to dilute solutions. Thus, for example, a solution of normal blood serum containing 1 part in 1,000 invariably gives a reliable reaction with the corresponding prepared serum.

C. A. M.

The Determination of Aloins in Aloes. E. Léger. (*Journ. Pharm. Chim.*, 1902, xv., 519-522.)—For the isolation of barbaloin, isobarbaloin, and other aloins, the author boiled 500 grammes of the aloes with a mixture of 1,800 c.c. of chloroform and 600 c.c. of methyl alcohol for four hours under a reflux condenser. After settling, the supernatant liquid was decanted and distilled, and the residue taken up with absolute alcohol, from which crystals of aloins separated in three to four days. By this means from 5 to 6 per cent. of barbaloin, free from isobarbaloin, were obtained from Cape aloes, and about the same quantity from Barbadoes aloes. Curaçoa aloes yielded about 10 per cent. of aloins, consisting of approximately equal proportions of barbaloin and isobarbaloin. From Jafferabad aloes more than 20 per cent. of aloins, consisting mainly of isobarbaloin, were isolated, whilst Socotrine aloes gave only about 4 per cent., consisting almost exclusively of barbaloin, with a minute quantity of isobarbaloin. Barbaloin was identified by the characteristics of its chlor-acetyl derivative, which melts at 146·6° C. (corr.), and forms quadratic yellow anhydrous crystals only slightly soluble in hot alcohol, but very soluble in benzene. Isobarbaloin was identified by Klunge's reaction (ANALYST, xxvii., 193), and by its bromine derivative, which is slightly soluble in cold alcohol, from which it crystallizes in yellow needles. Neither of these aloins was found in Natal aloes, which, however, yielded the two analogous compounds—nataloin, and its lower homologue, homonataloin.

C. A. M.

TOXICOLOGICAL ANALYSIS.

Estimation of Arsenic in Toxicology. G. Todeschini. (*Boll. chim. farm.*, 1902, xli., 185; through *Chem. Zeit. Rep.*, 1902, 141.)—From experiments on flesh, to which known amounts of arsenic trioxide had been added, the author finds that Gautier's process for the determination of arsenic, even when the improvements recommended by its inventor in 1899 are made use of, only returns one-third of the

arsenic in the form of a mirror, the other two-thirds being lost. This loss is due to the fact that the carbonaceous residue retains much of the arsenic in a form insoluble in water; while if the said residue is warmed, partial reduction of the arsenic acid to arsenious acid occurs, and the latter volatilizes. When Gautier's solution is treated with sulphuretted hydrogen all the arsenic is not precipitated, probably because destruction of the organic matter is incomplete. Selmi's process is better, as only one-half the arsenic is lost. F. H. L.

Selmi's Process for the Determination of Arsenic in Toxicology. G. Giudice. (*Gazz. chim. Ital.*, 1902, xxxii. [1], 164; through *Chem. Zeit. Rep.*, 1902, 141.)—In using this process, if the apparatus is put together with rubber corks or tubes containing antimony sulphide, considerable quantities of antimony accompany the arsenic in the cold receiver, even if the temperature of the oil-bath in which the retort and first receiver are placed does not exceed 130° C., so that the mirror may consist in large part of antimony instead of arsenic. If the material under examination contains antimony compounds, antimony will contaminate the arsenic if the temperature is allowed to reach 130° C., but will not enter the cold receiver provided the oil-bath is kept below 115° C. Mercury and tin salts do not affect the working of Selmi's process, as they are not driven over even at a temperature of 130°. F. H. L.

ORGANIC ANALYSIS.

On Herzig and Meyer's Method of Determining Methyl. M. Busch. (*Berichte*, 1902, xxxv., 1565-1567.)—The modification of Zeisel's method devised by Herzig and Meyer affords a means of determining the methyl in combination with nitrogen, as well as of that combined with oxygen, and of distinguishing between the two in certain cases. Thus, whilst the methoxyl group is hydrolyzed by being boiled with hydriodic acid, a much higher temperature (200° to 300° C.) is as a rule required to dissociate the methyl group from the nitrogen. In some cases, however, *e.g.*, 1-phenyl-4-methylanilino-urazole, the methyl is liberated from the nitrogen by the boiling acid, and the author therefore concludes that when the test gives a negative result the absence of methoxyl can be regarded as proved, but that a positive result cannot be accepted as conclusive of methylimin without further evidence. C. A. M.

Separation of Cholesterin and Phytosterin from Mixtures of Fatty and Mineral Oils. J. Marcusson. (*Mitth. Königl. Techn. Versuchsanst.*, Berlin, 1901, xix., 259; through *Chem. Zeit. Rep.*, 1902, 154.)—The author has already described (Analyst, 1901, xxvi., 302) two processes for the above purpose. The following method is specially suitable for such mixtures as contain very viscid mineral oils. It does not yield quantitative results, but if 100 grammes of the sample are taken it enables the vegetable or animal oil to be identified in presence of a mineral oil. The oil is saponified with alcoholic potash, the solution is diluted with an equal

volume of water, and the mixture is shaken out several times with petroleum spirit till the mineral oil is extracted. The alcohol is driven off from the residual liquid, which is then agitated repeatedly with ethyl ether to dissolve the cholesterin and phytosterin. On distilling away the ether and recrystallizing from alcohol the cholesterols of the fats may be recovered pure in the usual manner.

F. H. L.

The Quantitative Estimation of Colophony in Fats, Oils, Soaps, Ceresin, Paraffin, etc. Holde and Marcusson. (*Mittheil. aus den Königl. techn. Versuchsanstalt.*, 1902, 40-49.)—As the amount of resin in soaps and oils cannot be accurately estimated by either Twitchell's or Gladding's processes, the authors recommend a method which is a combination of these two processes. The results of test experiments, given in the original paper, show that very accurate results can be obtained in this way. The method is as follows:

(*a*) *In Fats and Soaps containing no Unsaponifiable Matter.*—About 5 grammes of the sample (correspondingly more in the case of soap containing water) are weighed out and boiled with 50 c.c. of alcoholic potash for half an hour under a reflux condenser. The alcoholic solution is then evaporated, the residue dissolved in water and decomposed with hydrochloric acid. Soaps containing no free fat may be directly dissolved in water and decomposed with acid. The separated fatty acids are removed by shaking with ether; the aqueous acid solution is neutralized, evaporated to about 25 c.c., re-acidified and shaken out with ether. After distilling off the ether from the united ethereal extracts, the residue of fatty acids is dissolved in 50 c.c. of absolute alcohol, and the acids converted into esters by passing a moderately rapid current of dry hydrochloric acid gas through the solution cooled by ice-water to a temperature not above 10° C. When the operation is complete (it usually takes one to two hours) the flask and its contents are allowed to stand for half an hour at the ordinary temperature. The contents are then washed into a large Erlenmeyer flask with five times their volume of water, and boiled under a reflux condenser for half an hour. The cooled solution is now shaken out with 100 c.c. of ether in a separating funnel, and then with several successive quantities of 50 c.c. of ether until the extracts are colourless. The aqueous liquid is neutralized, evaporated to 50 c.c., acidified, and repeatedly extracted with small quantities (25 c.c.) of ether. In this way the water-soluble constituents of the colophony are obtained. After mixing the ethereal solutions they are shaken out with about 50 c.c. of potash solution (10 grammes of caustic potash, 10 grammes of alcohol, and 100 c.c. of water). A brown layer separates out between the ether and the alkaline solution, and is drawn off with the latter It contains a considerable portion of the resin-soap, which is only slightly soluble in the potash solution. The ether is then well washed with water to remove soluble resin-soaps, again with two successive quantities (10 c.c.) of the potash solution, and finally with water until the washings are colourless. In the presence of fish-oil acids or much colophony the washing with water must be very thorough. To remove any fatty esters which may have been mechanically carried into the alkaline aqueous liquors, the latter are shaken with 50 c.c. of ether.

After separating the ether it is extracted with 5 c.c. of the potash solution, and the aqueous alkaline extract added to the main bulk of the same. This is now acidified and shaken out with successive quantities (50 c.c.) of ether until completely extracted. The acid solution is neutralized, evaporated to a small bulk, re-acidified, and again shaken out with ether. The total ether extracts are washed with 20 c.c. of water, and the ether is distilled off. The residue of resin-acids so obtained—still contaminated with unchanged fatty acids—is placed in a tared glass basin and evaporated with several small successive additions of absolute alcohol to remove the last traces of water, and weighed. The fatty acids still remaining in the resin-acids are removed by the employment of Gladding's process. To this end from 0·4 to 0·6 gramme of the above obtained resin-acids are placed in a 100 c.c. stoppered and graduated cylinder, and dissolved in 20 c.c. of 95 per cent. alcohol. If only a small amount of resin-acid is obtained, the following proportions of the ether-alcohol mixture must be correspondingly altered, whilst, in the case of a large yield of acids, it is advisable to dissolve the whole in so much 95 per cent. alcohol that 20 c.c. of the solution shall contain 0·5 gramme of resin-acid. A drop or two of phenolphthalein solution are added to the alcoholic solution in the cylinder, and then concentrated caustic soda solution (1 of NaOH to 2 of water), until the reaction is just alkaline. The loosely stoppered cylinder and its contents are heated for a short time in the water-bath, then cooled, ether is added up to the 100 c.c. mark, and mixed. One gramme of dry powdered silver nitrate is now added, and the contents of the cylinder are shaken for fifteen to twenty minutes to convert the resin-acids into silver salts. When the insoluble silver salts have completely separated and settled (after standing overnight if necessary), 70 c.c. of the solution are pipetted into a second 100 c.c. cylinder and shaken with 20 c.c. of dilute hydrochloric acid (1 : 2). The ether layer is drawn off, and the aqueous portion twice shaken out with 20 c.c. of ether. The united ether extracts are washed with 20 c.c. of water, filtered into a small flask, and the ether is distilled off. The residue, amounting to about 10 c.c., is transferred to a weighed dish, evaporated, dried for a short time at 110° to 115° C., and weighed. The weight of the resin-acids so found is calculated back into the first weight (impure acids) obtained, and then on the original substance taken. The percentage found is corrected by the subtraction of 0·4 per cent., this allowance being made for a small amount of fatty acid which is always present. As colophony contains an average of 8 per cent. of unsaponifiable matter, a second correction is therefore necessary, the true percentage of colophony in the substance under examination being found by the following equation, in which the two corrections are combined:

$$100\,\frac{(\text{percentage of resin acids found} - 0{\cdot}4)}{92} = \text{percentage of colophony.}$$

Should more than 20 per cent. of colophony be present, it is better to directly estimate the unsaponifiable matter. The latter is contained in the ethereal solution of the fatty esters after the resin acids have been removed. After saponifying the esters by the addition of 25 c.c. of N. alcoholic potash, the solution is diluted with 150 c.c. of water and shaken out twice with 150 c.c. of ether. The main bulk of the ether is distilled off, and the remainder allowed to be evaporated at the ordinary temperature. (By warming, volatile substances are lost.) An oily residue remains,

which is freed from traces of soap by treating it with a little alcoholic potash, slowly evaporating off the alcohol, and extracting this residue with petroleum spirit.

(*b*) *In Fats and Soaps containing Unsaponifiable Matter.*—A sufficient quantity of the sample is weighed out to yield about 5 grammes of fatty acids; benzene (free from thiophene) is added, and the sample is saponified. The unsaponified matter is separated from the soap solution in the usual way, and the resin and fatty acids in the latter estimated by the process given above. An accurate estimation of the unsaponifiable substances in this case is not possible, but they may be approximately calculated by assuming that the colophony found to be present itself contains on the average 8 per cent. of these substances.

(*c*) *Estimation of Colophony in Ceresin and Paraffin.*—The resin is removed from the sample by thorough extraction with boiling 70 per cent. alcohol. The united alcoholic extracts are filtered when quite cold, and the alcohol is distilled off from the clear filtrate. The residue is dried at 110° to 115° C., and weighed. Should fatty acids also be present, the residue, obtained after the distillation of the alcohol, must be treated according to the method described under (*a*). W. P. S.

Larch Turpentine and Venice Turpentine. L. E. Andés. (*Chem. Rev. Fett- u. Harz-Ind.*, 1902, ix., 126-128.)—*Larch Turpentine*, obtained from the trunk of the larch-tree, was formerly known also as Venice turpentine from the fact that Venice was the chief emporium for it; but this is no longer the case, and the name "Venice turpentine" is now applied to artificial mixtures of rosin, rosin oil, and turpentine used in the manufacture of sealing-wax and varnish. Larch turpentine has a pleasant odour, a bitter taste, and a yellow or brown colour. It is readily soluble in alcohol, ether, acetic acid, and acetone, and partially soluble in carbon bisulphide. It consists of a dextro-rotatory rosin and a lævo-rotatory volatile oil. According to Dieterich, it gives the following values: Acid value, 66·92 to 68·85; ether value, 46·27 to 54·94; saponification value, 114·5 to 127·71; acetyl acid value, 69·87 to 72·19; and acetyl saponification value, 178·95 to 190·86. The following results were obtained by Beckurts and Bruche in the examination of seven samples: Specific gravity, 1·060 to 1·190; acid value, 76 to 101; ether value, 0 to 9; and saponification value, 81 to 101.

Venice Turpentine.—In addition to the artificial product, there is also a commercial French product, "*térébenthine de Venise*," which is a superior variety of balsam obtained from shore pines. An artificial product examined by Dieterich had the following characteristics: Acid value, 98·79; ether value, 0·88; and saponification value, 97·66. In order to distinguish between larch turpentine and an artificial mixture, the conclusions drawn from the odour, inflammability, solubility in alcohol (90 per cent.), and analytical values may be confirmed by Hirschsohn's ammonia test. Ordinary turpentine, on treatment with five times its volume of ammonia solution (specific gravity, 0·96), gradually yields a milky emulsion, whilst in the case of larch turpentine the liquid remains clear. When the lower layer of larch turpentine is stirred it is gradually transformed into a semi-solid, opaque substance, whilst the supernatant liquid becomes slightly turbid. Ordinary turpentine, how-

ever, is immediately distributed, and the milky emulsion rapidly solidifies to a gelatinous mass. In the case of a mixture of the two in equal parts, the substance is distributed throughout the ammonia, and a solid mass, which clears on heating, is obtained in about five minutes. When the mixture only contains about 20 per cent. of ordinary turpentine the milky emulsion becomes clear on heating the tube in boiling water, but no solidification occurs. Comparative tests with genuine larch turpentine may serve to detect smaller quantities. When 1 part of the sample is shaken with 30 parts of 80 per cent. alcohol a clear and permanent solution is obtained with larch turpentine, whilst in the case of ordinary turpentine about half of the substance soon separates out. C. A. M.

The Use of Iodine Monochloride in the Determination of the Iodine Absorption of Oils. J. J. A. Wijs. (*Zeit. für Untersuch. der Nahr. und Genussmittel*, 1902, v., 497-504.)—As regards the keeping qualities of the solution of iodine monochloride in glacial acetic acid, it is stated that the solution decreases in strength only to a very slight extent when carefully prepared. The presence of iodine trichloride causes a loss of strength, as does also the use of acetic acid containing water and reducing substances. In the same way ordinary Hübl's solution was found to diminish in strength according to the quality of the alcohol used in its preparation. The iodine values obtained by the employment of iodine monochloride agree with the theoretical numbers in the case of unsaturated fatty acids having only one double linking. In using Hübl's solution various precautions must be taken in order that the results may agree with those obtained by the iodine monochloride process (see ANALYST, xxiv., p. 259). W. P. S.

The Alkalinity of Crude Sugar. Lauterbach. (*D. Zuckerind.*, 1902, xxvii., 653 and 780; through *Chem. Zeit. Rep.*, 1902, 154.)—When crude sugar is stored for any length of time, bicarbonates are formed in it, while the water it contains becomes saturated with carbon dioxide. It is therefore necessary before titrating a sample for alkalinity with phenolphthalein to boil the liquid thoroughly. If this is done the results are perfectly accurate, and Herberger's objections (this volume, p. 196) to the use of that indicator are without point. F. H. L.

Identification of Sugars. E. Votocek. (*Chem. Listy*, 1902, xxvi., 122; through *Chem. Zeit. Rep.*, 1902, 141.)—The author finds that it is as easy to test for pentoses in any suitable hydrazone by distillation with 12 per cent. hydrochloric acid as in any other compound, the test being rendered additionally delicate by collecting a distillate of 180 c.c., and then redistilling it with sodium chloride, a method which enables, for example, 0·06 gramme of the methylphenylhydrazone of methylpentose to be recognised. Tested with phloroglucinol, 0·33 gramme of the benzylphenylhydrazone of arabinose gives a large greenish-black precipitate, 0·2 gramme of

the corresponding compound of xylose behaving identically. 0·3 gramme of the same hydrazone of galactose yields no precipitate with phloroglucinol, while those of rhamnose and rhodeose from jalapin or convolvulin give cinnabar-coloured precipitates. In presence of furol, methylfurol may be discovered by means of resorcinol, as the gray furol resorcide does not mask the carmine colour of methylfurol resorcide. F. H. L.

A New Method for the Determination of Cellulose. S. Zeisel and M. J. Strittar. (*Berichte*, 1902, xxxv., 1252-1255.)—The authors' method is based upon the fact that cellulose in the narrower sense (dextro-cellulose) is not converted to any large extent into products soluble in dilute ammonium hydroxide, when oxidized by potassium permanganate in the presence of nitric acid, whereas the non-cellulosic constituents of wood readily yield oxidation products, part of which are soluble in water, whilst part can be extracted with 2·5 per cent. ammonium solution.

From 1 to 1·5 gramme of the finely divided material is stirred with dilute nitric acid, and a 3 per cent. solution of potassium permanganate introduced, 1 c.c. at a time, until the red colour of the liquid is plainly perceptible after thirty minutes, the oxidation taking about two hours in all. The excess of permanganate and the precipitated manganese dioxide are then destroyed by the addition of sulphur dioxide or sodium bisulphite, and the liquid filtered. The residue is washed with water, then treated for forty-five minutes with a 2·5 per cent. solution of ammonia at 60° C., and again washed successively with hot water, alcohol, and ether.

In this way oak raspings were found to contain 37·2 per cent. of cellulose. The results were concordant, but were much lower than those obtained by Schulze's chlorate process, although showing a satisfactory agreement with those given by the tedious process of Schulze and Henneberg, in which the wood is extracted with water and alcohol, and oxidized for days with a solution of potassium chlorate in nitric acid.

About 30 per cent. of the cellulose is converted into oxycellulose by oxidation with permanganate, but the slight error thus introduced can be corrected by extracting the residual cellulose with a boiling 10 per cent. solution of sodium hydroxide, in which the oxycellulose dissolves. The amount of soluble compounds formed from the cellulose in the oxidation does not exceed 4 per cent. Hemi-celluloses are completely converted into soluble oxidation products. C. A. M.

Detection of Pentoses in Urine in the Presence of Glycuronic Acids. K. von Alfthan. (*Arch. Experiment. Pathol.*, 1902, xlvii., 417; through *Chem. Zeit. Rep.*, 1902, 154.)—On treatment with benzoyl chloride and sodium hydroxide both pentoses and glycuronic acids are converted into benzoyl esters. When these are saponified with sodium ethoxide the glycuronic acids separate out, the pentoses remaining in solution. If, then, the filtrate yields the phloroglucinol or orcinol test, pentoses must be present in the urine. F. H. L.

A Reagent for Albumin in Urine. Pollacci. (*Giorn. di farm. di Trieste*, 1901, 235; *Ann. de Chim. anal.*, 1902, vii., 195.)—The reagent consists of 1 gramme of tartaric acid, 5 grammes of powdered mercuric chloride, and 10 grammes of pure sodium chloride dissolved in 100 c.c. of water, and mixed with 5 c.c. of formalin.

Two c.c. of this reagent are placed in a test-tube, and 3 to 4 c.c. of the urine under examination carefully poured down the side of the tube so as to avoid mixing the liquids. In the case of pathological urine, a white zone is immediately produced at the junction of the liquids, whilst normal urine does not give any reaction until after a lapse of ten to fifteen minutes.

The limit of sensitiveness of the reaction is 1 in 370,000. C. A. M.

Valuation of Rubber Goods. O. Mayer. (*Chem. Zeit.*, 1902, xxvi., 481.)—In this article the author points out that there is no method which can be considered universally applicable to the examination of indiarubber goods. Heintz has not submitted sufficient evidence to prove that the substance left after the various foreign ingredients have been removed by appropriate solvents agrees with the formula $(C_{10}H_{16})_n$; indeed, in view of the way in which caoutchouc may be decomposed during its incorporation with "substitutes," etc., and of its liability to change during the extraction of those substitutes, such a method of ultimate analysis as is recommended by Heintz (this volume, p. 200) is not likely to yield trustworthy results. Even the Henriques process cannot be regarded as a routine method, for it needs modification to suit different grades of material; and there are, in fact, on the market now certain descriptions of rubber wares which are not amenable to the Henriques treatment without considerable alteration in the usual procedure. Mayer considers it unfortunate that manufacturers have been led to believe that reliable methods of valuation have already been elaborated. F. H. L.

A Reaction distinguishing between α- and β-Naphthols. A. Jorissen. (*Ann. de Chim. anal.*, 1902, vii., 217-219.)—A pinch of the naphthol is treated with about 2 c.c. of an aqueous solution of iodine and potassium iodide, and the liquid shaken with an excess of an aqueous solution of sodium hydroxide. A clear, colourless liquid is obtained with β-naphthol, whilst in the case of α-naphthol there is turbidity and an intense violet coloration. When mixtures of the two naphthols are thus tested the liquid assumes a more or less pronounced violet colour. C. A. M.

The Volumetric Determination of Thymol. E. Zdarek. (*Zeit. anal. Chem.*, 1902, xli., 227-331.)—This is an application of Koppeschaar's method of determining phenol, the thymol being precipitated by bromine, and the excess of the latter titrated with sodium thiosulphate after the addition of potassium iodide and starch solution. The solutions employed by the author are the same as those of Koppeschaar, with the exception of the bromine solution, which is of twice the strength. They are as follows: (1) An aqueous solution of sodium thiosulphate (9·76 grammes per litre),

corresponding to a solution of iodine containing 5 grammes per litre; (2) an aqueous solution of potassium iodide containing 125 grammes per litre; (3) an aqueous solution containing in a litre 3·571 grammes of dry sodium bromate and 12·178 grammes of dry sodium bromide. On mixing 25 c.c. of this solution with 10 c.c. of the iodide solution (2) and 5 c.c. of concentrated hydrochloric acid, the liberated iodine is equivalent to 90 c.c. of the sodium thiosulphate solution (1).

In making a determination, the dry thymol is weighed into a flask provided with a stopper, and for each 0·1 gramme 20 c.c. of the bromide solution (3), and 4 c.c. of concentrated hydrochloric acid are added. The flask is well shaken for about five minutes, after which 10 c.c. of the potassium iodide solution and a little starch solution or paste are introduced, and the contents immediately titrated with the thiosulphate. According to the results of the author's analyses, 1 molecule of bromo-thymol contains 4 atoms of bromine. In ten test determinations thus made, the amounts of thymol found varied from 98·6 to 100·2 per cent. of the theoretical quantity. The bromine compound gradually loses bromine when kept in a desiccator over sulphuric acid, until finally a stable compound corresponding to dibromo-thymol is left. On treating thymol with a large excess of bromine an oily compound was formed, which, when kept for some days in a sealed glass tube, yielded a deposit of nearly colourless crystalline needles, melting at 71° C., and having the composition of a thymol containing 5 atoms of bromine.

The author has used this method to determine the solubility of thymol, and has found that 1 gramme dissolves in 1176·4 c.c. of water at 19·4° C. At 15° to 20° C. 1 part of thymol is soluble in 0·24 to 0·28 part by weight of strong alcohol (90 to 91·2 per cent. by volume), in 0·22 to 0·26 part of ether, and in 0·67 to 0·7 part of chloroform. C. A. M.

Colour Reaction for Thiophen. **H. Kreis.** (*Chem. Zeit.*, 1902, xxvi., 523.)—If a very weak solution of thalline base (tetrahydro-*p*-oxyquinoline methyl ester) in petroleum spirit is shaken with a liquid containing thiophen and with some 1·4 nitric acid, a distinct, but transient, violet colour is produced, which gradually becomes reddish, and finally yellow. Addition of water destroys the colour, so that weaker nitric acid must not be employed; stronger acid is also to be avoided. The test can be used to show either thiophen or thalline in very minute quantities. It is very convenient for the detection of thiophen in benzene, and it serves equally for the recognition of methylthiophen in toluene. Other alkaloids shaken with benzene containing thiophen and nitric acid do not yield noteworthy colour reactions. Bellier's test for sesamé oil (ANALYST, 1900, xxv., 50), which is somewhat similar, does not, however, depend on the presence of thiophen. F. H. L.

The Volumetric Determination of Disodium Methyl-arsenate. **E. Falières.** (*Journ. Pharm. Chim.*, 1902, xv., 466-469.)—Silver methyl-arsenate is sufficiently soluble in water to prevent an exact gravimetric determination of the sodium salt by precipitation with silver nitrate. It is, however, completely insoluble in a $\frac{N}{10}$ or $\frac{N}{20}$ solution of silver nitrate, and on this fact the author bases his method of estimation.

Disodium methyl-arsenate crystallizes with 6 molecules of water, which it loses at 120° to 130° C., but regains to a large extent on exposure to the air. The author prefers to take the formula, $As(CH_3)O_4Na_2.6H_2O$, as typical of the salt, since this does not alter in composition after an exposure of several days to the air.

In the volumetric method 0·2 gramme of the crystalline salt (from which chlorides, sulphates, arsenites, arsenates, phosphates, carbonates, and iodides have been proved to be absent) is dissolved in 10 c.c. of water, and the solution mixed with 40 c.c. of $\frac{N}{10}$ silver nitrate solution, and rapidly filtered. The filtrate is used to titrate 10 c.c. of $\frac{N}{10}$ sodium chloride solution diluted with 30 c.c. of water, and the amount of silver nitrate still present is thus found.

The amount of disodium methyl-arsenate corresponding with the amount of silver nitrate used in the precipitation is then found by means of the formula

$$\frac{292 \times N \times 5 \times 100}{340},$$

where N represents the weight of silver nitrate consumed, 292 the molecular weight of disodium methyl-arsenate, and 340 twice the molecular weight of silver nitrate.

C. A. M.

The Precipitation of Alkaloids, Metallic Salts, and Proteids by Extracts of Coffee and Tea. T. Sollmann. (*Journ. Med. Research*, Ohio, 1902, 43-53; through *Amer. Journ. Pharm.*, 1902, lxxiv., 299-303.)—According to the results of the author's experiments, the reactions given by tea tannin closely resemble those of gallotannic and quercotannic acid, and differ greatly from those given by coffee tannin (a diglycosyl ester of cinnamic acid). The extracts used in the experiments were prepared by boiling the tea or roasted coffee for forty-five minutes with 10 parts of water, and filtering the liquid. Neither extract gave any precipitate with Mayer's reagent or with hydrochloric acid in the dilution in which they were used in the tests. The proportions usually employed in the case of alkaloids were 1 c.c. of the decoction to 2 c.c. of a 1 per cent. aqueous solution of the alkaloid or its salt, or 5 c.c. each of the alkaloidal solution (1 : 1,000), and of the decoction.

Alkaloids.—Atropine, coniine, morphine, and pyridine were not precipitated, even from a moderately concentrated solution by coffee, but were precipitated by tea from strong solutions. Aconitine, brucine, cocaine, lobeline, nicotine, and pilocarpine were sparingly precipitated from weak solutions by tea, but not by coffee, even when they were present in strong solutions. Apomorphine, the cinchona alkaloids, hydrastine, strychnine, and veratrine were precipitated by both tea and coffee from weak solutions. None of the alkaloids except apomorphine was completely precipitated.

Metallic Salts.—Tea was found to effect a more complete precipitation than coffee. Aluminium, lead, and silver were precipitated practically completely by both, whilst mercury was partially precipitated by tea, but not by coffee.

Proteids (Egg-white, Albumose, Gelatin).—A sharp differentiation between the tannins of tea and coffee could be effected by means of these proteids. The tea decoction gave a large precipitate with them, whereas the coffee decoction was unaffected, or, at most, rendered slightly turbid. C. A. M.

The Kjeldahl Process. **K. Neuberg.** (*Beitr. chem. Physiol. u. Pathol.*, 1902, ii., 214; through *Chem. Zeit. Rep.*, 1902, 141.)—In order to destroy the amido-mercuric sulphate which is produced in the Kjeldahl flask when mercury is employed, the author recommends sodium thiosulphate. This has the advantage of being fit for use in the solid form, so that dilution of the liquid is avoided. F. H. L.

INORGANIC ANALYSIS.

A Note on the Volumetric Determination of Copper. **S. W. Parr.** (*Journ. Amer. Chem. Soc.*, xxiv., 580.)—In the method depending on the oxidation by permanganate of cuprous thiocyanate (*Journ. Amer. Chem. Soc.*, xxii., 685) the end-reaction is sometimes unsatisfactory. This can be obviated by the following modification: The washed precipitate of cuprous thiocyanate and the asbestos pulp are returned to the original beaker, 10 c.c. of a 10 per cent. potassium hydroxide solution and 10 c.c. of ammonia (specific gravity, 0·96) are added, and potassium permanganate solution is immediately added until, upon warming to 50°, a green colour remains. About one-third or one-fourth of the quantity of permanganate necessary for this is then run in, and the whole allowed to stand for five minutes, acidified with 25 c.c. of sulphuric acid (1 : 1 or 2), and the titration finished as usual. The results obtained with this method are very good. To calculate results, the iron value of the permanganate is multiplied by the factor 0·1602. A. G. L.

The Volumetric Determination of Copper by means of Potassium Iodide. **F. M. Litterscheid.** (*Zeit. anal. Chem.*, 1902, xli., 219-227.)—On treating a solution of a copper salt with sulphur dioxide, and then adding potassium iodide in slight excess, the copper is precipitated quantitatively as represented in the equation

$$2CuSO_4 + 2KI + SO_2 + 2H_2O = Cu_2I_2 + 2KHSO_4 + H_2SO_4.$$

The solution of the copper salt, which should be neutral or only slight acid, and should contain not less than 0·1 gramme of copper, is mixed with a few c.c. of sulphur dioxide solution, and then with a slight excess of decinormal potassium iodide solution. After standing for an hour for the cuprous iodide to become crystalline, the liquid is made up to definite volume and filtered, and an aliquot portion of the filtrate mixed with an excess of decinormal silver nitrate solution, and then with 10 c.c. of dilute nitric acid, and titrated with decinormal thiocyanate solution, with iron ammonium sulphate as indicator. Lead, mercury, and other metals precipitated under these conditions must be absent, and also substances that liberate iodine from potassium iodide.

Copper and Silver.—About 1 gramme of the alloy is dissolved in nitric acid, and the solution mixed with about 5 c.c. of dilute sulphuric acid, and evaporated nearly to dryness. It is then diluted to about 50 c.c., and any separated silver sulphate brought into solution by warming. When cold, 1 drop of a 5 per cent. solution of potassium nitrite and some starch paste are introduced, and the silver titrated with decinormal potassium iodide. The liquid is then filtered, and the copper determined in the filtrate as described above.

Copper and Bismuth.—The solution of the alloy is concentrated to a small volume, the bismuth separated as basic carbonate by the addition of ammonium carbonate and ammonia, and the copper determined in the filtrate. The method is also applicable to the determination of nickel and zinc in the presence of copper. When lead is present, it is first determined in the form of sulphate. C. A. M.

Preparation of Arsenic-Free Zinc. Otto Hehner. (*Jour. Soc. Chem. Ind.*, 1902, xxi., 675.)—Zinc suitable for use in the Marsh-Berzelius test is prepared as follows: Melt about a pound or two of ordinary block-zinc, no matter how impure, in a clay crucible over a good gas fire. When quite fluid, throw into the metal a piece of sodium, taking for each pound of zinc about 1 gramme of sodium at a time. Stir the molten metal with a piece of hard-glass tubing bent at right angles. A black scum forms immediately, which is removed with a china spoon or a crucible lid held in the tongs. Stir vigorously, and remove the scum from time to time till the sodium appears to have oxidized out; then add another piece of sodium, stir and skim as before, and oxidize well. This takes altogether about ten minutes. Finally, pour out the metal into a second clean clay crucible, and repeat the sodium treatment once more. It is best to keep two crucibles with file-cuts for the two stages. Allow the molten metal to cool considerably before granulating, as when the zinc is very hot and fluid heavy drops like shot are obtained, whereas when the zinc is near its solidifying point, thin flakes, presenting a large surface to the acid, are produced. A. M.

The Electrolytic Determination of Bismuth. O. Brunck. (*Berichte*, 1902, xxxv., 1871-1873.)—Winkler's method (*Berichte*, xxxii., 2192), in which wire gauze is employed as the cathode, has been found by the author to yield good results in the determination of bismuth. The metal or its salt is dissolved in nitric acid, the amount of which may be from twenty to twenty-five times that of the bismuth, though its strength must not exceed about 2 per cent. Another essential condition is that the tension of the current must not exceed 2 volts. The permissible strength of the current varies with the concentration of the solution. Thus, if more than 0·1 gramme of bismuth in 100 c.c. be present, a current of 0·5 ampère or more may be employed, whilst with less than 0·05 per 100 c.c., a current not exceeding 0·1 ampère is best. The electrolyte is first heated to 70°–80° C., so that its resistance is lessened, and it is possible to transmit a fairly large current, notwithstanding the low tension. As the solution cools and becomes poorer in metallic ions the strength of the current diminishes, until at length it falls to only a few hundredths of an ampère. The deposition of even large quantities of bismuth is complete in two to three hours, and when the above conditions are observed the gray deposit is compact and adherent. After completion of the electrolysis both electrodes are transferred to a beaker of water, and the current continued for a short time, in order to effect the deposition of any bismuth dissolved by the adherent nitric acid. Finally, the cathode is washed successively with water, alcohol, and ether, and weighed. The results of the test experiments described agree well with the theoretical amounts.

Sulphuric acid alone is not a suitable solvent for the metal, owing to its being necessary to use such large quantities to prevent the formation of basic salts. All the attempts to separate lead from bismuth by this means were unsuccessful, the lead peroxide invariably containing more or less bismuth. C. A. M.

On the Compounds of Tellurium with Bismuth and the Quantitative Separation of the Two Elements. A. Gutbier. (*Zeits. Anorg. Chem.*, xxxi., 331.)—In the analysis of various mixtures of bismuth and tellurium prepared by himself, the author has examined three methods of separating these two elements. He condemns the first, in which tellurium is precipitated by sulphurous acid, bismuth being thrown down by hydrogen sulphide in the filtrate; and the second, in which bismuth is first precipitated as oxychloride, as being inexact. He obtained good results, however, with the third method, which depends on the solubility of tellurium sulphide in alkaline sulphides. The method was carried out as follows: The powdered substance was dissolved in aqua regia, and the solution repeatedly evaporated on a water-bath with hydrochloric acid until the smell of chlorine had disappeared. After diluting with water as far as possible without causing bismuth oxychloride to separate, and heating to 60° to 70°, the solution was saturated with hydrogen sulphide, the precipitate allowed to settle, and then filtered through a weighed filter-paper placed in a funnel with ground edges, and having a stopcock fitted to its stem. The filtrate and washings were concentrated and again treated with hydrogen sulphide, but one precipitation was generally found to be sufficient to throw down the whole of the elements.

The precipitated sulphides were then treated on the filter with warm potassium sulphide solution until all the tellurium was extracted, the residue washed thoroughly with water, finally with alcohol and carbon bisulphide, dried at 100°, and weighed as Bi_2S_3. The tellurium was precipitated in the filtrate by cautiously adding hydrochloric acid and gently heating. After filtering off, the precipitate was dissolved in fuming nitric acid, the solution evaporated repeatedly on the water-bath with hydrochloric acid, the residue dissolved in water and a little hydrochloric acid, and boiled with an excess of barium bicarbonate solution to remove sulphuric acid. In the filtrate from the barium sulphate and carbonate, tellurium was precipitated by any one of the usual methods and weighed as Te. The author finds it best to use a Neubauer's (platinum) crucible for the filtration and drying of the tellurium, on account of the ease with which it oxidizes. A. G. L.

A New Qualitative Test for Cobalt. J. L. Danziger. (*Journ. Amer. Chem. Soc.*, xxiv., 578.)—About 5 c.c. of the solution to be tested is acidified with hydrochloric acid, solid ammonium thioacetate added, followed by a few drops of stannous chloride, and an equal volume of amyl alcohol; mixtures of acetone and ether, or alcohol and ether, may also be used, though less efficiently. The whole is well shaken and allowed to stand. If cobalt is present the upper layer will be coloured an intense blue from the formation of the double salt $(CH_3COS)_2Co$, $2CH_3COSNH_4$. The test is as sensitive as Vogel's (ANALYST, xxvi., 218), and will serve

to detect 1 part of cobalt in 500,000 parts of water. The object of adding stannous chloride is to reduce any ferric iron, which would give a deep red colour with the reagent. A. G. L.

Estimation of Titanium in Steel and Iron. G. B. Waterhouse. (*Chem. News*, lxxxv., 198.)—For the estimation of titanium in steels or pig-irons 5 grammes of the drillings are dissolved in 50 c.c. of strong hydrochloric acid, the solution is evaporated to dryness, the residue baked, heated for a few minutes with about 20 c.c. hydrochloric acid, and the solution boiled, after the addition of 70 c.c. water, until all the chlorides are dissolved. The solution is then filtered, the insoluble matter thoroughly washed with dilute hydrochloric acid, and the volume of the filtrate made up to about 150 c.c. Dilute ammonia is then added till a small, permanent precipitate is obtained, which is dissolved with a few drops of hydrochloric acid, after which 50 c.c. of a 20 per cent. solution of sodium sulphite are slowly added, any precipitate or dark colour being removed with a little dilute sulphuric acid. The solution is then heated to boiling, a hot solution of 50 c.c. glacial acetic acid and 20 grammes sodium acetate added, and the whole boiled briskly for fifteen minutes. The precipitate formed is filtered off, thoroughly washed, and ignited together with the first insoluble residue.

The oxides obtained are fused for several minutes with 10 grammes of sodium carbonate; after cooling the melt is treated with 150 c.c. hot water, the precipitate well washed, transferred to a beaker, any adhering precipitate being dissolved in a little hydrochloric acid, and, after adding 10 c.c. dilute sulphuric acid, the solution is boiled down until sulphuric acid fumes come off, allowed to cool, diluted to 50 c.c., and filtered. The filtrate is made up to a volume of about 150 c.c., made slightly alkaline with ammonia, then just acid with hydrochloric acid, and, after adding 20 c.c. sodium sulphite solution, heated to boiling, when acetic acid and sodium acetate are added as before. After boiling for fifteen minutes, the precipitate is filtered off through a large double filter, well washed, ignited, and weighed as TiO_2.

The above method was tested on samples of iron to which known quantities of a standard titanium solution had been added, and gave good results, even in the presence of chromium, aluminium, nickel, tungsten, molybdenum, or vanadium, the largest error being found in the presence of 1·1 per cent. of vanadium, in which case a percentage of 1·048 Ti, instead of 1·016, was found. A. G. L.

The Electrolytic Determination of Vanadium. P. Truchot. (*Ann. de Chim. anal.*, 1902, vii., 165-167.)—This method is based upon the fact that a hot, slightly ammoniacal solution of sodium vanadate is decomposed by an electric current, with the deposition of hydroxide or a mixture of hydroxides of vanadium on the cathode.

The solution of the salt, which in the author's experiments contained from 0·012 to 0·05 gramme of V_2O_5 in 200 c.c. was rendered slightly alkaline with 20 to 30 drops of ammonium hydroxide, heated to 80° to 85° C., and electrolyzed with a current of 2 to 2·5 volts and 0·3 ampère for eight to ten hours, the liquid being meantime kept at the same level by the addition of ammoniacal warm water. The platinum

cone with the deposit was then washed with water and with alcohol, and ignited in a muffle for a few minutes to convert the hydroxides into vanadic anhydride (V_2O_5), allowed to cool slowly in a dry atmosphere, and weighed.

The results thus obtained were within 0·0005 gramme of the theoretical amounts.

C. A. M.

INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND.

THE Council of the Institute of Chemistry has decided that examinations for persons desirous of qualifying themselves to be public and technical analysts shall be held in Dublin in the month of July, 1903.

The examinations will be open only to candidates who have complied with the regulations of the Institute.

The following is a list of the names of the candidates who passed the examination of the Institute of Chemistry held in July, 1902:

INTERMEDIATE EXAMINATION.—Twenty-four candidates presented themselves; the following (twelve) passed: W. L. St. J. Alton, University College, London, and under M. W. Blyth, F.I.C. M. Barrowcliff, University College, Notts. P. H. Carpenter, Finsbury Technical College. R. W. Clarke, Finsbury Technical College. O. C. M. Davis, University College, Bristol. J. F. P. Fielding, King's College, London. G. W. Glen, Glasgow and West of Scotland Technical College. B. F. Howard, Finsbury Technical College. F. T. Jewson, University College, Notts. W. H. Keys, University of Birmingham. T. H. Lloyd, University College, Cardiff. E. Smith, Glasgow and West of Scotland Technical College, and under Dr. A. Thomson, M.A., F.I.C.

FINAL A.I.C. EXAMINATION.—Branch "A" (*Mineral Chemistry*): Seven candidates presented themselves; the following (three) passed: A. E. Garland, Associate Royal College of Science, London. J. L. Garle, University College, London. G. C. Jones,* Associate City and Guilds Institute, London. Branch "B" (*Metallurgical Chemistry*): Two candidates presented themselves and passed: W. B. Parker, University of Birmingham. J. C. Sheldon, University of Birmingham, and under A. E. Tucker, F.I.C. Branch "C" (*Physical Chemistry*): Two candidates presented themselves; one passed: H. Bassett, B.Sc. Lond., University College, London. Branch "D" (*Organic Chemistry*): Six candidates presented themselves; one passed: S. Andrews, B.Sc. Lond., Associate Royal College of Science, London. Branch "E" (*Analysis of Food and Drugs, including Examination in Therapeutics, Pharmacology, and Microscopy*): Eight candidates presented themselves; the following (five) passed: G. J. Alderton, King's College, London. R. Glegg, B.Sc. Aberdeen. E. V. Jones, University of Birmingham. W. H. Roberts, M.Sc., Victoria University College, Liverpool. H. P. Stevens,* B.A. Oxon., Ph.D. Heidelberg.

The examiners in General Theoretical and Practical Chemistry were Dr. Bernard Dyer, F.I.C., and Dr. W. Palmer Wynne, F.R.S., F.I.C. The examiner in Therapeutics, Pharmacology, and Microscopy was Dr. Arthur P. Luff, F.R.C.P., F.I.C.

* For fellowship (F.I.C.).